Spin Cycle
Hurricane Energetics

Recent EOSDIS products improve our knowledge of the components affecting the energy in tropical cyclones.

Wind — Cloud Top and Sea Surface Wind Vectors
Terra/MISR and QuikSCAT/SeaWinds Overpasses of Hurricane Debby on August 21, 2000

MISR

Visible Radiances | Cloud Top Heights | Cloud Top Winds

SeaWinds
Sea Surface Wind Vectors

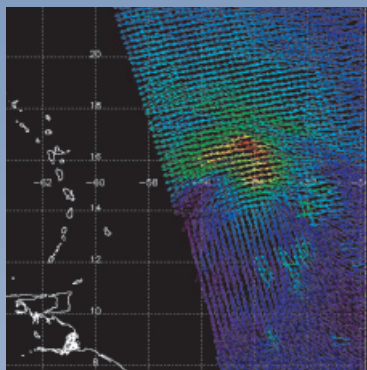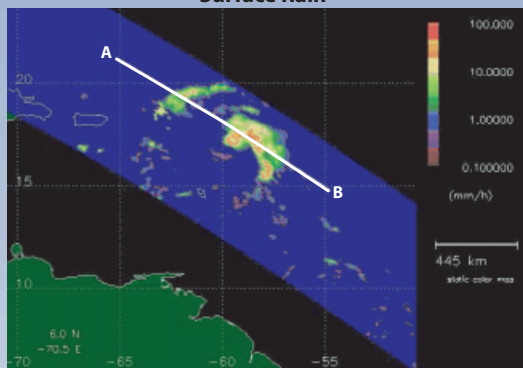Images courtesy of NASA/GSFC/LaRC/JPL MISR Team

Image courtesy of the SeaWinds on QuickSCAT Project, JPL/NASA

Cloud top heights and winds from MISR can be combined with sea surface wind vectors from SeaWinds to produce a multilayer view of horizontal wind fields.

Precipitation — Surface and Vertical Profiles
TRMM Microwave Imager (TMI) views of Hurricane Debby on August 22, 2000
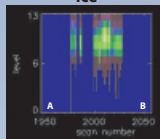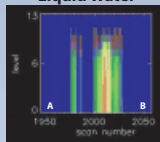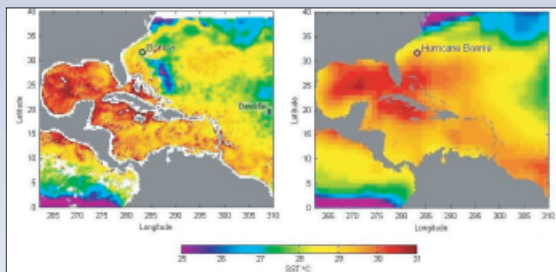
Surface Rain

Vertical Profiles

Ice

Liquid Water

TMI-derived precipitation rates and vertical profiles of ice and liquid water can be tied to the transfer and release of energy within storms.

The white line locates the vertical profiles.

Images created with the TSDIS Orbit Viewer

Temperature — Sea Surface
TMI vs. Reynolds views of Hurricanes Bonnie and Danielle in late August 1998

Images courtesy of Remote Sensing Systems

Bonnie
Danielle

Hurricane Danielle weakened when it hit the cooler water (shown in blue) upwelling in Bonnie's wake.

Through cloud cover, TMI detects the cooler water in Bonnie's wake (left image) that was missed by AVHRR IR used in Reynolds Weekly SST (right image).

National Aeronautics and Space Administration

Monitor Tropical Cyclone Energetics Using EOSDIS Data

The energy driving a tropical cyclone's development depends on the temperature of the ocean over which the storm is passing. The effects of sea surface temperature on a storm are seen in the strength of its winds, and in the intensity and spatial distribution of its precipitation. Recently deployed satellite sensors permit improved measurements of these key parameters related to storm energetics, which are available in products distributed by the EOS Data and Information System (EOSDIS). Used synergistically, the data can lead to a better understanding of tropical cyclone dynamics. EOSDIS data products are available from the Distributed Active Archive Center (DAAC) Alliance and from the EOS Data Gateway (EDG) unless otherwise noted.

Terra MISR. Multi-angle Imaging SpectroRadiometer (MISR) cloud heights are derived from stereoscopic observations. This method has the advantage of not needing assumptions about atmospheric temperature profiles required for previous (e.g., GOES) cloud height retrievals. The visible radiance image is included for visual reference only. Cloud top heights are depicted in shades ranging from blue (low, 1–2 km) to red (high, 12–14 km). Cloud top winds at ~70-km resolution are determined for high and low clouds using an automatic feature-tracking algorithm. Arrows indicate the wind direction, with longer arrows for higher wind speeds. Cloud top heights, wind speeds, and wind directions are found in the MISR Cloud Stereo Product (MIL2TCST). Data are available from the LaRC DAAC.

This preview product is available at http://eosweb.larc.nasa.gov/DATDOCS/misr_L2_order.html.
Data Set: MISR Level 2 TOA/Cloud Stereo Data
Data Granule ID: MISR_AM1_TC_STEREO_P226_O003600_F06_0009.hdf

QuikSCAT SeaWinds. Microwave scatterometers can retrieve oceanic vector winds through cloud cover, adding data obtained at the surface to vector winds measured at various cloud heights by MISR and GOES. The SeaWinds surface wind vectors are produced at 25-km resolution. The wind overlay image was produced by William Daffer of JPL. Higher velocities are shown ranging from green to yellow to red. The SeaWinds overpass (~0900 Z) was within 5 hours of the MISR observations (~1345 Z). Data are available from the JPL DAAC.

Data Set: QuikSCAT Level 2B Ocean Wind Vectors in 25 Km Swath Grid
Date Range: August 18–22, 2000
Data Granule ID: 108.QSCAT_L2B_0815

TRMM TMI – Precipitation. The Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI) measures the intensity and spatial distributions (vertical and horizontal) of different types of precipitation. Rain bands are clearly shown in the surface rainfall image. Vertical distributions of precipitating ice and liquid water along a portion of the TMI swath are shown with the same intensity scale. Such measurements are important since precipitation involves the vertical transfer of latent heat within a storm. The TSDIS Orbit Viewer used to make the precipitation images is available for a variety of platforms from http ://tsdis.gsfc.nasa.gov/orbitviewer.html. Data are available from the GSFC DAAC.

This product is available at http://lake.nascom.nasa.gov/data/dataset/TRMM/01_Data_Products/01_Orbital/05_Tmi_Prof_2A_12/index.html.
Data Set: 2A12: Hydrometeor Profile (TMI)
Data Granule ID: 2A12.000822.15739.5.HDF

TRMM TMI – Sea Surface Temperature (SST). TMI also can measure SST, adding critical data from cloud-covered areas to forecast models. TMI SST data are included in an ocean product (with cloud liquid water, water vapor, precipitation rates, and wind speeds) produced by Remote Sensing Systems (RSS). The TMI 3-day-averaged SST map includes data from the four granules listed below. Data are available from the GHRC.

Data Set: TRMM Microwave Imager (TMI) Wentz Ocean Products
Date Range: August 24–26, 1998
Data Granule IDs: tmiwop_1998.235_daily, tmiwop_1998.236_daily, tmiwop_1998.237_daily, and tmiwop_1998.238_daily

Reynolds Weekly SST. This blended product of AVHRR IR retrievals and buoy SSTs, commonly used to initialize weather and climate models, has a spatial resolution of 1 degree. The three images at the bottom of the poster are adapted from the RSS hurricane Web page at http://www.ssmi.com/hurricanes.html. Data are available from the JPL DAAC.

Data Set: NCEP Reynolds Optimally Interpolated Sea Surface Temperature Data Sets
Data Set Granule ID: 119.OISSTWEEKLY1981-NOW

To search and order data available from the EDG, see http://eos.nasa.gov/imswelcome
For information about the data centers of the DAAC Alliance, see http://nasadaacs.eos.nasa.gov
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